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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Thomas Hanemann

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EXAMINER

REDDY, KARUNA P

ART UNIT

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/551,471	Applicant(s) HANEMANN ET AL.	
	Examiner KARUNA P. REDDY	Art Unit 1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 April 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 and 10-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 6,7,12,13 and 18-20 is/are allowed.
- 6) ☒ Claim(s) 1-5, 8, 10-11, 14-17 and 21-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This office action is in response to amendment filed 4/24/2008. Claims 1-2, 5-7, 17-20 are amended; claim 9 is cancelled; and claims 21-22 are added. Accordingly, claims 1-8 and 10-22 are currently pending in the application.
2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1 and 22 recite the limitation "said two or more isocyclic rings" in claims 1 (lines 11-12) and 22 (line 9). There is insufficient antecedent basis for this limitation in the claims, because organic compound is either (1) or (2). Thus, the recitation of "said two or more isocyclic rings" in (2) lacks antecedent basis because (1) is a different organic compound from (2).

Claims 2-5, 8, 10-11, 14-17 and 21 are subsumed by this rejection because of their dependence on claim 1.

4. Claims 2 (line 2) and 3 (line 2-3) recite the limitation "the condensed aromatic ring". There is insufficient antecedent basis for this limitation, because claim 1 recites two condensed aromatic ring compounds (isocyclic condensed aromatic ring compound and

heterocyclic condensed aromatic ring compound) and it is unclear which condensed aromatic ring compound is being claimed.

Claim Rejections - 35 USC § 103

5. Claims 1-5, 8, 10-11, 14-17 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ducharme et al (5, 064, 264) in view of Chemla et al (Nonlinear Optical Properties of Organic Molecules and Crystals, Academic Press 1987).

Ducharme et al disclose polymeric materials that exhibit an erasable photorefractive effect which can be fabricated into optical devices such as optical wave guides (abstract). The present invention relates to an amorphous or substantially amorphous erasable photorefractive material comprising a polymer and a non-linear optical chromophore (column 2, lines 24-28). The non-linear optical chromophore can be dispersed in the polymer binder as a guest/host material (column 2, lines 47-49). Suitable polymers in the present invention include polyacrylates (column 2, lines 51-56).

Ducharme et al is silent with respect to condensed aromatic ring systems; and their dissolution in the polymer.

However, Ducharme teaches that suitable chromophores for use will be known to those skilled in the art such as those disclosed in "Nonlinear Optical Properties of Organic Molecules and Crystals" by Chemla and Zyss, Academic Press 1987 (column 7, lines 14-18). Examples listed in Chemla et al include polynuclear aromatics such as 1,2-Benzanthracene and heterocyclic aromatic ring compound such as benzimidazole (table IV, page 245, lines 8 and 15). Therefore, it would have been obvious to one skilled in the art at the time of invention to use condensed aromatic compounds i.e. 1, 2-

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benzanthracene and benzimidazole of Chemla et al, in place of the chromophore of Ducharme et al, to obtain a material which can be fabricated into an optical waveguide.

With respect to 2,3-benzanthracene of claim 8, it is held by court that structural similarities have been found to support a prima facie case of obviousness and 2,3-benzanthracene is a structural isomer of 1,2-benzanthracene. See *In re Wilder*, 563 F.2d 457, 460, 195 USPQ 426, 429 (CCPA 1977).

With respect to dissolution of the organic compound, given that the polymeric material and organic compounds are substantially similar to those that are claimed and the materials are used for similar purposes i.e. as an optical waveguide, dissolving organic compound in polymer is within the scope of one skilled in the art.

6. Claims 8 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ducharme et al (5, 064, 264) in view of Chemla et al (Nonlinear Optical Properties of Organic Molecules and Crystals, Academic Press 1987) and Gott (J. Phys. B: Atom. Molec. Phys., 1971, Vol. 4)

The discussion with respect to Ducharme et al in view of Chemla et al in paragraph 5 above is incorporated here by reference.

However, Ducharme et al in view of Chemla et al is silent with respect to organic ring systems phenanthrene and anthracene.

However, Chemla et al teach that primary references should be further consulted for additional examples (page 221, lines 6-9). The primary reference of Gott cited in Chemla et al teaches optical second-harmonic generation coefficients of several organic molecular crystals (abstract). A correlation between structural effects and non-linear optical properties is found in a number of aromatics, in that a polarizable benzene

nucleus is present in each molecule (page 116, lines 16-19). See table 1 for a listing of aromatic compounds, that include phenanthrene, 1, 2-benzanthracene and anthracene, all of which have a non-linear coefficient greater than 0. Therefore, it would have been obvious to one skilled in the art at the time of invention to use condensed aromatic ring compounds i.e. phenanthrene, anthracene of Gott in place of the chromophore of Ducharme et al in view of Chemla et al, to obtain a material which can be fabricated into an optical waveguide.

Allowable Subject Matter

7. Claims 6-7, 12-13 and 18-20 are allowed for the following reasons -

It is noted that claims 6-7, 12-13 and 18-20 recite use of aromatic ring systems benzoquinoline, 1,10-phenanthroline, phenanthridine, 1,7-phenanthroline, benzofuran and 1,2-benzoxazole in an optical waveguide. The closest prior art, viz., Fujiyama et al (US 2003/0085387 A1), Heyningen et al (US 2003/0161605 A1), Ducharme et al (5, 064, 264), Chemla et al (Nonlinear Optical Properties of Organic Molecules and Crystals, Academic Press 1987) and Gott (J. Phys. B: Atom. Molec. Phys., 1971, Vol. 4), taken individually or in combination, do not disclose or suggest aromatic ring systems benzoquinoline, 1,10-phenanthroline, phenanthridine, 1,7-phenanthroline, benzofuran and 1,2-benzoxazole. Thus, Fujiyama et al and Heyningen et al disclose aromatic fused ring systems as part of larger molecules, Ducharme et al discloses chromophores that have unsymmetrical, polarized, conjugated π electrons between a donor and acceptor group, Chemla et al discloses 1,2-benzanthracene and Gott discloses anthracene, 1,2-benzanthracene and phenanthrene, all of which do not include benzoquinoline, 1,10-

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phenanthroline, phenanthridine, 1,7-phenanthroline, benzofuran and 1,2-benzoxazole as the aromatic ring system.

Response to Arguments

8. The rejection of claims 1-4, 10 and 15-16 set forth in paragraphs 5-6 of office action mailed 11/27/2007 has been withdrawn in view of the amendment.
9. Applicant's arguments filed 4/24/2008 with respect to prior art rejection in paragraph 9 of office action mailed 11/27/2007 have been fully considered but they are not persuasive. Specifically, applicant argues that (A) Ducharme describes non-linear optical chromophore as having unsymmetrical polarized, conjugated pi electrons between a donor and acceptor groups and none of the examples are condensed rings; (B) In applicant's view the Ducharme reference to Chemla does not require all of Chemla recited information unless that information is consistent with Ducharme requirements of non-linear optical chromophore; (C) The combination of 1,2-benzanthracene and polymer of the rejected claims is unobvious over the requirements of Ducharme - Chemla combination. There is no USPTO showing that the requirements of Ducharme of dispersal or covalent reaction of the dopants with the polymer are satisfied by the PTO's specific reliance and reference to Chemla; (D) absent a showing that Ducharme requirements of unsymmetrical, polarized, conjugated pi electrons between a donor and acceptor groups are satisfied by all compounds in Chemla, use of Chemla, in the grounds of rejection requires hindsight; (E) the use of organic molecular crystals like 1,2-benzanthracene as a chromophore in the photorefractive material of Ducharme will not

result in a solution of an organic compound in a polymer (emphasis added by applicant). Chemla as well as Ducharme are silent about preparing a solution in the polymer; and (F) Ducharme describes a crosslinking chemical reaction between the chromophore and polymer. A dispersion according to the Ducharme seems to be a crosslinked chromophore in a polymer. Therefore, the suggestion from Ducharme is that monomer should be functionalized prior to polymerization; (G) One skilled in the art will not take 1,2-benzanthracene as well as 3,4-benzopyrene to produce a solution of the organic compound in a polymer because Ducharme teach crosslinking and there is no hint to produce a solution of crystals or powders in a solution; (H) Gott teaches that the properties of organic crystals may be controlled by their structure; (I) Gott teachings concerning crystals are inconsistent with applicants recitation of dissolved; and (J) Gott's teachings are inconsistent with the teachings of Ducharme that molecules of crystals are crosslinked to a polymer as they no longer retain their identity.

With respect to (A), it is noted that if Ducharme et al described condensed aromatic ring systems, the rejection would have been anticipatory, which it is not.

With respect to (B), it is the examiner's position that one skilled in the art looking to Ducharme would recognize that the chromophore of Ducharme exhibits non-linear optical behavior. Applicant's attention is drawn to page 222, lines 2-3 of Chemla which states that a number of novel and important non-linear organic molecules were discovered. Examples listed in Chemla include the presently claimed condensed aromatic ring compounds (hetero- as well as isocyclic aromatic ring compounds). Gott cited in Chemla teaches specifically that correlation between structural effects and non-linear optical properties can best be studied using organic compounds containing highly polarizable benzene nucleus and substituent chromophoric groups can however be

changed, thus affecting the overall polarizability of the molecule i.e. benzene nucleus is polarizable and whether substituents are present on the polarizable molecules depends on overall polarizability required.

With respect to (C), Chemla is relied on only for substituting the chromophore of Ducharme with chromophores of Chemla referred to in Ducharme. In addition, when the rejections are based on a combination, all elements of rejected claim are required to be present in the combination and not in each individual reference.

With respect to (D), Contrary to applicant's allegation that Chemla cannot be used in the rejection unless all compounds fit into the class of non-linear optical chromophores required by Ducharme (i.e. unsymmetrical, polarized, conjugated pi electrons between a donor and acceptor groups) is without merit, because Ducharme states that "other suitable chromophores for use in the present invention will be known to those skilled in the art such as those disclosed in "Nonlinear Optical Properties of Organic molecules and Crystals" by Chemla." It is the examiner's position that any unsymmetrical, polarized organic compound containing pi electrons is within the scope of one skilled in the art.

With respect to (E), (G) and (I), applicant's attention is drawn to the new grounds of rejection in paragraph 5 above, necessitated by the amendment that organic compound is dissolved in the polymer.

With respect to (F) and (J), applicant's attention is drawn to col. 2, lines 47-49 of Ducharme which states that NLO chromophore can be dispersed in the polymer binder or alternatively, can be covalently bonded. In addition at col. 3, lines 2-4, Ducharme states that preferably, such polymer has NLO chromophore covalently bonded to the polymer. This indicates to one skilled in the art an alternative or preferred embodiment

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in which NLO chromophore is bound to the polymer and not that covalent bonding is required.

With respect to (H), applicant's attention is drawn to abstract of Gott where it states that "variations in coefficients for related compounds can be correlated with differences in molecular structure." Furthermore, at page 116, lines 23-28 Gott states that some lend themselves to correlation between structural effects and non-linear optical properties. Such a group is formed by aromatic compounds because highly polarizable benzene nucleus is present in each molecule. Thus, it is apparent that Gott's study is geared towards the relationship between molecular structure and non-linear optical behavior and not crystal structure as alleged by applicant.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the

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advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KARUNA P. REDDY whose telephone number is (571)272-6566. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vasu Jagannathan can be reached on (571) 272-1119. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Karuna P Reddy/
Examiner, Art Unit 1796

/VASUDEVAN S. JAGANNATHAN/
Supervisory Patent Examiner, Art Unit 1796

